



# Perspectives on Networked Warfare

## Outline

- **Historical Perspective**
- **Technical Directions**
- **Trends and Observations**





# Big Safari



**Cobra Ball**



**Rivet Joint**



**Compass Call**



# Deep Strike



**Pave Mover - JSTARS**



**Data Fusion/Correlation**



**Air Interdiction**



**ATACMS**





# From Sensor to Shooter

**The goal is to cut the targeting cycle to 10 minutes or less**

**“First we collect then we analyze then we report. Does that sound time critical to anybody here?”**

***Gen. John P. Jumper  
Air Force Chief of Staff***

***Quoted in Air Force Magazine  
February 2002***





# Remotely Piloted Vehicle with Synthetic Aperture Radar

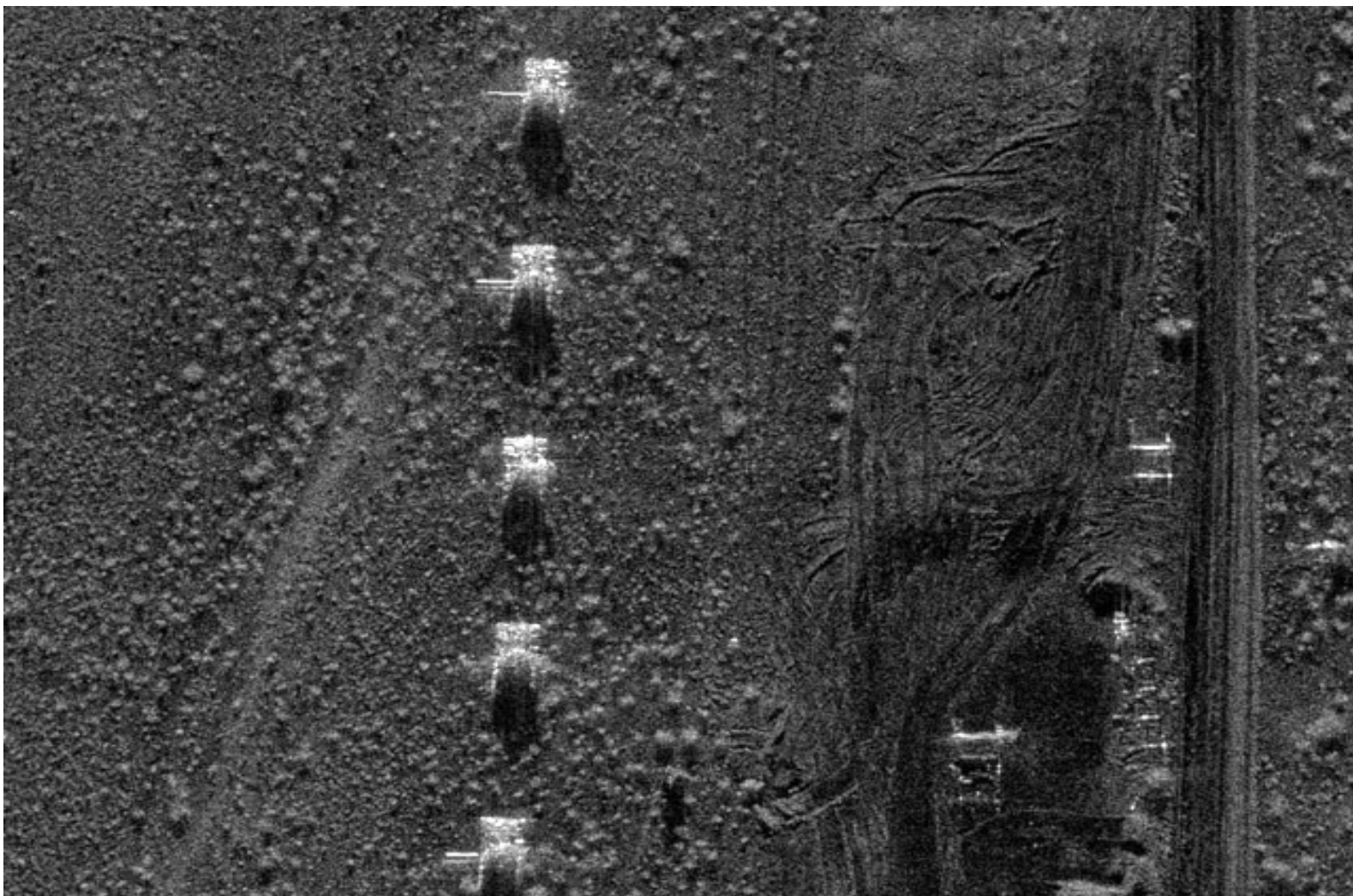


Lynx SAR





# Tank Imagery at 4 inch Resolution



*Official Use Only*

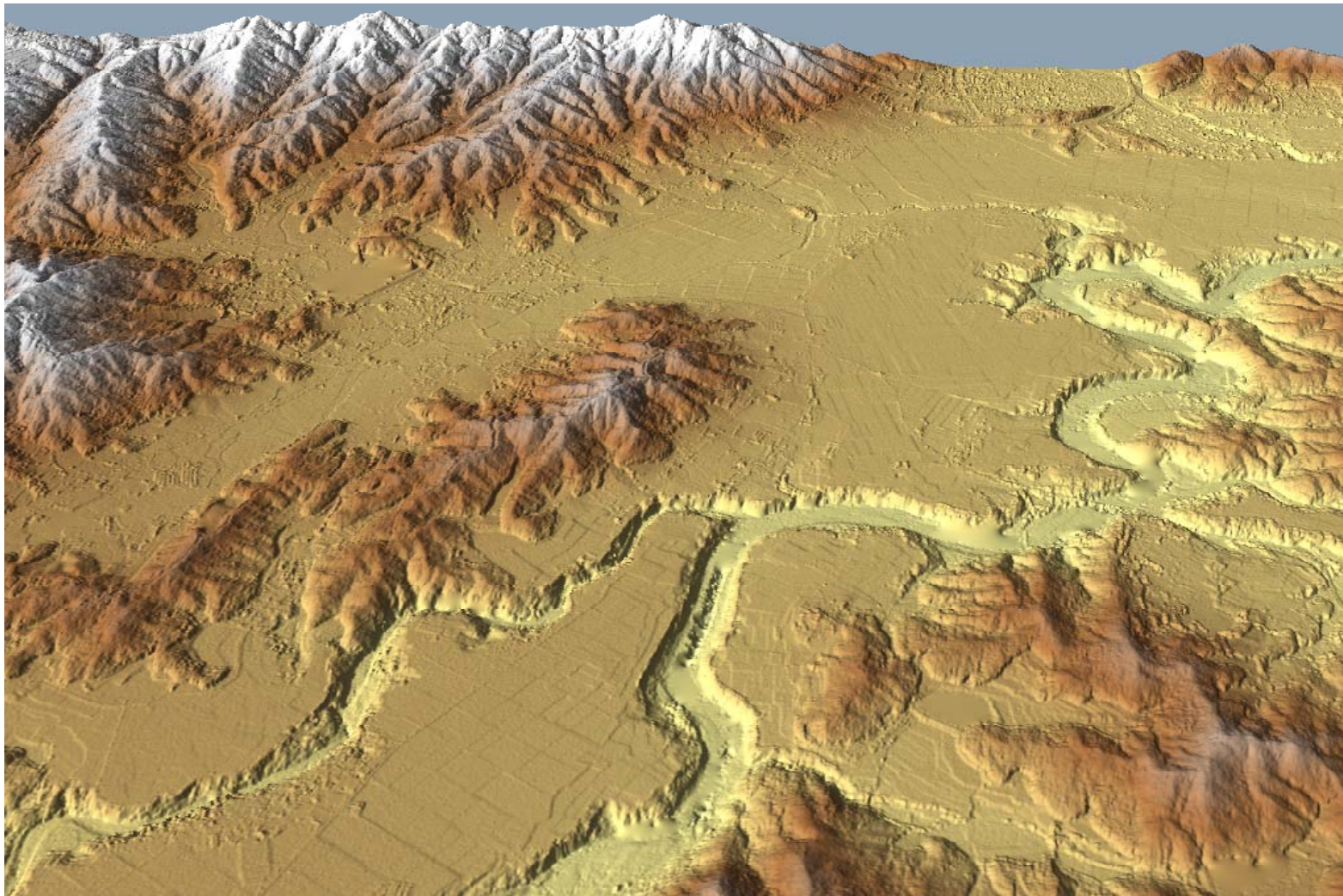


Sandia  
National  
Laboratories





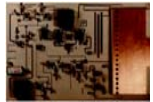
# 3D SAR Rice Fields in Korean Valley



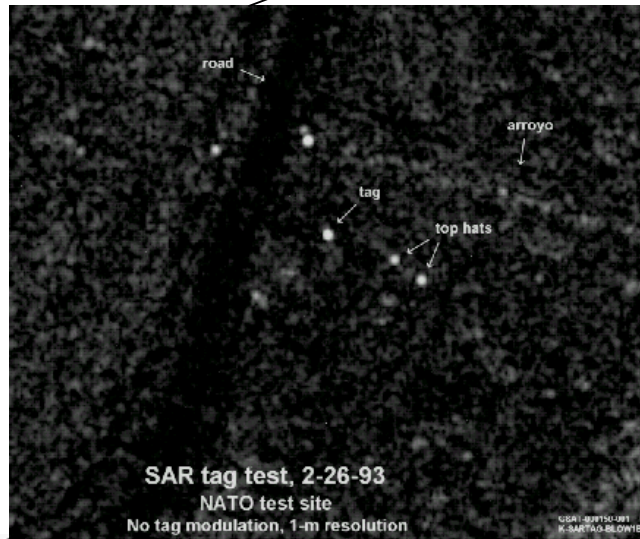
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# Battlefield Monitoring of Soldiers Tagging System

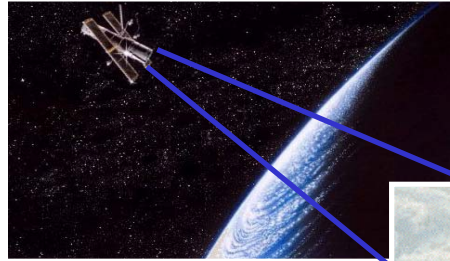
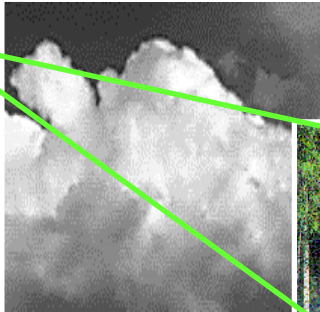


**Information dissemination  
via radar tag to JSTARS**





# ELIOT -- Enhanced Laser Imaging of Obscured Targets



**Other EO & RF Reversible  
& Permanent Effects**



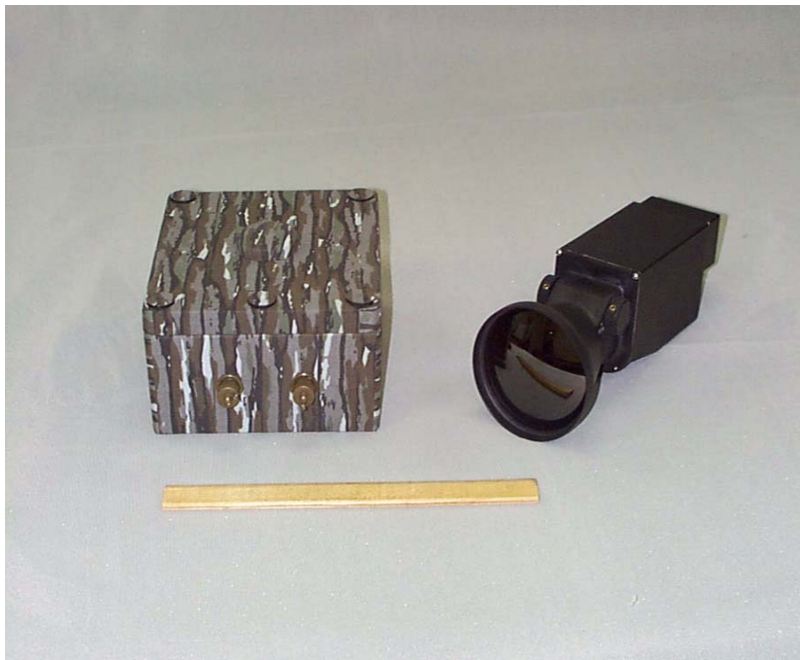
**Potential  
Close-in  
Terminal  
Defense**

**HILITE: High Intensity Laser  
Initiated Transient Electromagnetics  
– Flexible EM Effects at Range**

*Official Use Only*



# Unattended MASINT Sensors Detect & Identify Moving Vehicles



**Steel Rattler: Hand emplaced variant**



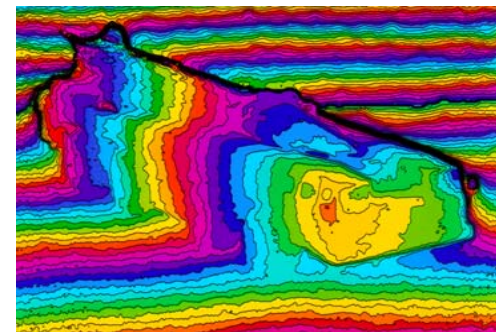
**Steel Eagle: Air emplaced variant**

# New Generations of Small Sensors

## Scannerless Range Imager (SRI) Sensor



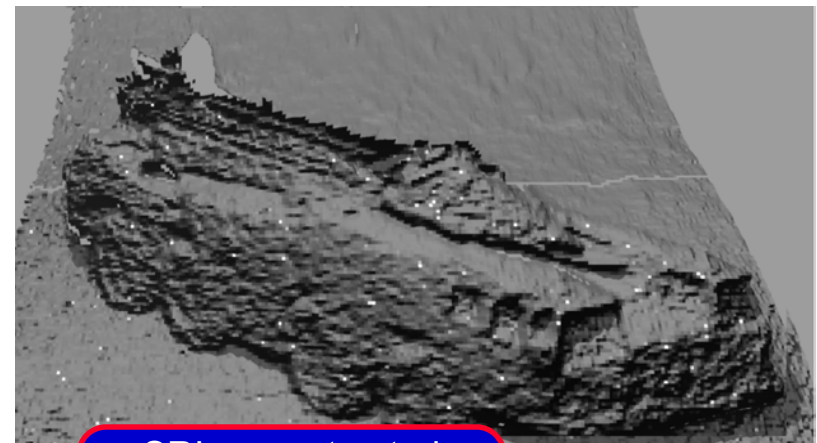
video



LADAR range info



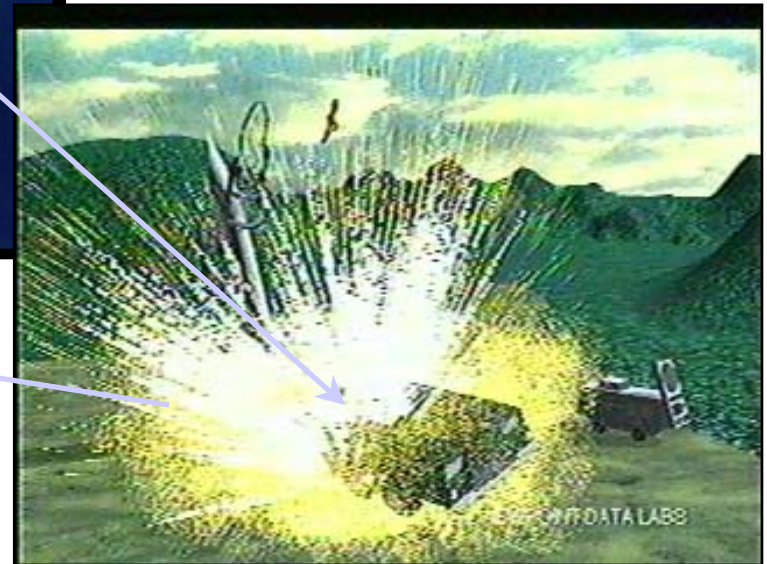
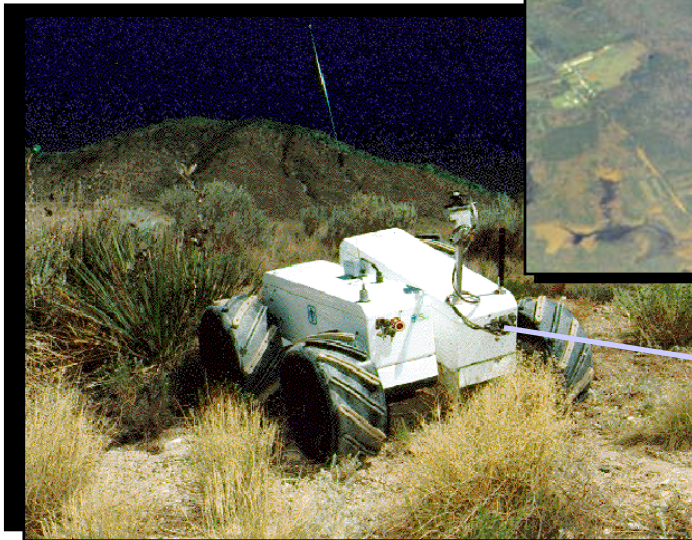
## Small Capable Chem Bio Senosrs



SRI reconstructed  
image enabling  
Automated Target  
Recognition (ATR)

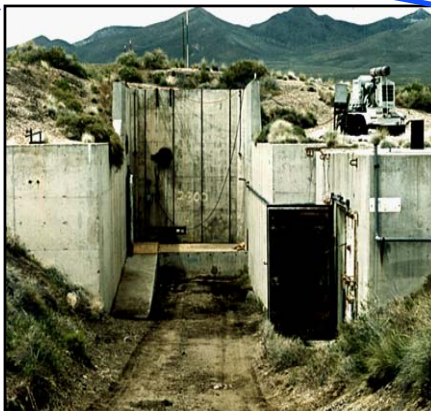


# Autonomous Systems Will Locate and Designate Targets and Assess Damage from Remote Fire



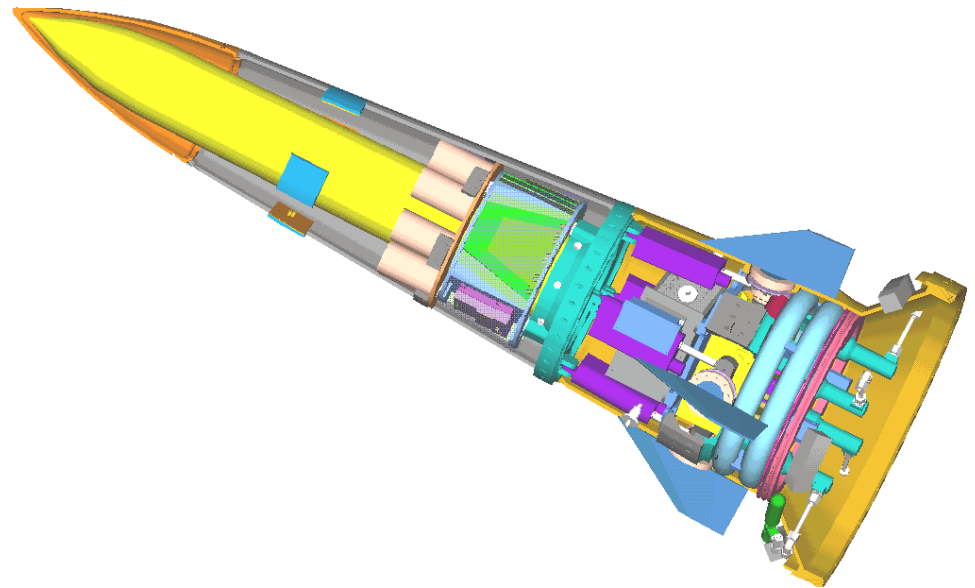
**Ground**

- **Advanced discrimination and processing algorithms**
- **Sensor deployment schemes**
- **Passive and active monitoring and imaging**
- **Phenomenological understanding (esp. for deep underground structures)**



- Seismic
- Acoustic
- EM

# ATACMS - P



**Warhead Penetrator**

*Official Use Only*







# Trends

- **Near all-weather operations is close to a reality**
- **Sensors, communications and geolocation miniaturizations have resulted in unprecedented proliferation**
- **Data fusion and integration is becoming more difficult as the numbers of sensors increase and the requirements for timeliness and precision become more stringent**
- **Architecture issues are becoming more complex as sensors proliferate and time critical issues are addressed**





# Observations

- **Low cost weapons guidance coupled with sensor webs have increased the application of smart weapons with significant performance and supportability implications**
- **Necessary time line reductions will be facilitated by technology advances but the human dimension must be included before significant weaponization of time critical targets will be achieved**
- **Application of space is becoming routine and transparent. GPS utilization is the enabler for low cost webs and weapons. This dependence also produces vulnerabilities**
- **The insertion of robots into sensor webs is an emerging capability with significant military implications**

